

APPLICATION OF PGNAA TO PHOSPHATE MINING

The INEEL has developed a nondestructive assay (NDA) method for locating and assaying phosphate ore beds. Proof of principle was carried out at an open pit phosphate mine in Idaho. The method makes use of the prompt gamma neutron activation analysis (PGNAA) technique. In this technique, a dig face is bombarded with neutrons, produced either by a neutron generator or by a small radioisotopic source such as ^{252}Cf . When these neutrons interact with the elemental constituents of the dig face, they produce gamma rays that are then measured. The energies of the gamma rays give a fingerprint of the elements in the material, and the intensities of the gamma rays give concentration information. Approximately a 6-inch radius active volume can be interrogated, depending upon the matrix material and the elements assayed. The figure shows the prototype unit being used at a phosphate mine. In this case, an isotopic source was used to produce the neutrons. In addition, the technique is applicable for bore-hole use,

Test/Calibration Facility for Bore-hole NDA Techniques

The INEEL is currently developing a test and calibration facility for bore-hole nondestructive assay (NDA) techniques. The facility is scheduled to begin operation during the fall of 2000. This is a unique facility designed for developing, testing, and calibrating NDA techniques such as prompt gamma neutron activation analysis (PGNAA), passive gamma-ray spectrometry, and other NDA techniques under simulated bore-hole conditions. It was designed to facilitate easy change-out of the surrounding matrix so that an instrument can be tested and calibrated for essentially an unlimited variety of surrogate materials. The figure shows an artist's conception of the facility with a PGNAA instrument in one of the test holes.

Unique Excitation Source for XRF Analysis

The INEEL has developed radioisotopic x-ray fluorescence (XRF) sources for use in mineral exploration and processing,

environmental remediation, and other industrial uses. For example, an x-ray fluorescence radioisotopic source, ^{59}Ni with an 80,000 year half life, has been demonstrated at INEEL for the in-field assay of elements between Ti, V, Cr, Mn. Detection limits for Cr in soil of < 10 ppm in a 20 min. count were achieved. The ^{59}Ni excitation source is in the shape of a washer with an external diameter of ~ 3" and a thickness of ~ 1/16", is maintenance free, and has an operational life exceeding the most dependable x-ray generator. The figure shows a typical arrangement for an annular excitation source of ^{59}Ni , detector, and sample holder. Development of a radioisotopic excitation source for in-field analysis of Cu, Zn, As, Se, Hg, and Pb is presently under consideration.

For information contact:

Jerry L. May
e-mail: jl原因@inel.gov
Phone: (208) 526-6674

John Alexander
e-mail: jala@inel.gov
Phone: (208) 526-0849



